Engineering cell-material interfaces for long-term expansion of human pluripotent stem cells.

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Funding Grants: A Novel Microenvironment-Mediated Functional Skeletal Muscle from Human Embryonic Stem Cells and their In Vivo Engraftment, Development of Synthetic Microenvironments for Stem Cell Growth and Differentiation

Public Summary:
This study described development of a synthetic matrix to support self-renewal of human pluripotent stem cells

Scientific Abstract:
Cost-effective and scalable synthetic matrices that support long-term expansion of human pluripotent stem cells (hPSCs) have many applications, ranging from drug screening platforms to regenerative medicine. Here, we report the development of a hydrogel-based matrix containing synthetic heparin-mimicking moieties that supports the long-term expansion of hPSCs (>/=20 passages) in a chemically defined medium. HPSCs expanded on this synthetic matrix maintained their characteristic morphology, colony forming ability, karyotypic stability, and differentiation potential. We also used the synthetic matrix as a platform to investigate the effects of various physicochemical properties of the extracellular environment on the adhesion, growth, and self-renewal of hPSCs. The observed cellular responses can be explained in terms of matrix interface-mediated binding of extracellular matrix proteins, growth factors, and other cell-secreted factors, which create an instructive microenvironment to support self-renewal of hPSCs. These synthetic matrices, which comprise of "off-the-shelf" components and are easy to synthesize, provide an ideal tool to elucidate the molecular mechanisms that control stem cell fate.